

**Abstract**

In one aspect, the invention provides methods and apparatus for forming optical devices on large area substrates. The large area substrates are preferably made of quartz, silica or fused silica. The large area substrates enable larger optical devices to be formed on a single die. In another aspect, the invention provides methods and apparatus for forming integrated optical devices on large area substrates, such as quartz, silica or fused silica substrates. In another aspect, the invention provides methods and apparatus for forming optical devices using damascene techniques on large area substrates or silicon substrates. In another aspect, methods for forming optical devices by bonding an upper cladding layer on a lower cladding and a core is provided.